the direct continuation northward of the Chesapeake formation of the Middle Atlantic slope.

W. B. Clark.

SOCIETIES AND ACADEMIES.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON, FEBRUARY 1.

Mr. Lester F. Ward read a paper on 'The Filiation of the Sciences.' The purpose of the paper was to trace the progress of the conception of a natural order of development for the larger groups of phenomena, as distinguished, on the one hand, from any attempt at a logical classification of the sciences, and on the other, from the consideration of the order in which the sciences have been historically developed. Without going back of the present century to deal with the more or less fanciful notions of the Ancients or of such moderns as Oken, Hegel, d'Alembert, Hobbes, Locke, etc., he drew attention to the views of Auguste Comte and Herbert Spencer, as the two philosophers who had clearly conceived the problem of natural evolution.

He first traced the development of the idea in the mind of the first of these writers from 1820 to 1842. In a paper published by him in 1820, he had quite clearly expressed the fundamental truth, and arranged the great groups of phenomena, or sciences, in the following order: 1, Mathematics; 2, Astronomy; 3, Physics; 4, Chemistry; 5, Physiology; giving to each of these terms a wide meaning, but admitting that mathematics was not coördinate with the others, but was only the criterion by which each of the others was to be judged and its position in the series fixed. From 1826 to 1829 he elaborated this scheme in a course of lectures, soon after published as his well-known work on Positive Philosophy, the first volume of which appeared in 1830. In the prospectus of these lectures, circulated in manuscript form in 1826, he added to the above five sciences a sixth, viz., Social Physics, and the scheme as then drawn up was introduced in tabular form at the beginning of the first volume of the Positive Philosophy. In Vol. III. of that work, which appeared in 1838, he substituted for his 'Physiology' Lamarck's term Biology, but the scope of this science was the same as before and practically that of biology as now understood. The last chapter of that volume was devoted to what he called the intellectual and moral, or cerebral, functions of life, in which he fully recognized the present science of psychology, but denied that it could be properly separated from biology. In the fourth volume, published in 1839, he speaks of this as 'Transcendental Biology.' It is in this volume, too, that he first proposed the term 'Sociology,' as the exact equivalent of his 'Social Physics,' and continued to the end to use both these terms interchangeably. It was not till 1842, with the appearance of the first volume of his Positive Polity (*Politique Positive*), that he added anything to the scheme of sciences thus drawn up. He then recognized, as the seventh and last term of the series, the science of Ethics. The entire series, then, as he finally left it, was as follows: 1, Mathematics; 2, Astronomy; 3, Physics; 4, Chemistry; 5, Biology (including cerebral or transcendental biology); 6, Sociology; 7, Ethics.

Comte was at great pains to explain that this series represented the true order of nature, and that the phenomena corresponded to the actual evolution that has taken place in the universe. The degree of 'positivity' of any science is that to which it can be reduced to mathematical laws. The first of the sciences that represent phenomena, viz., astronomy (from which sidereal astronomy was excluded) is therefore the most positive, and the degree of positivity diminishes with each term in the series. The sciences thus arranged also diminish in their generality while they increase in their complexity.

Moreover, each higher science has its roots in the one next below it and is, as it were, derived from it. The relationship is genetic, and hence his favorite term 'filiation,' a word much better chosen than the term 'hierarchy' which he also applied to the system.

Mr. Ward next proceeded to consider the scheme of Mr. Herbert Spencer as elaborated in his Synthetic Philosophy. A prospectus of that work was circulated in 1860. It was to embrace one volume on First Principles, two volumes on the Principles of Biology, two volumes on the Principles of Psychology, three volumes on the Principles of Sociology, and two volumes on the Principles of Morality. In this pro-

spectus, between the First Principles and the Principles of Biology, was inserted the following explanatory note: "In logical order should here come the application of these First Principles to Inorganic Nature. But this great division it is proposed to pass over, partly because even without it the scheme is too extensive, and partly because the interpretation of Organic Nature after the proposed method is of more immediate importance." This scheme of course was regarded by all as representing Mr. Spencer's conception of the natural order of evolution in the universe, and the arrangement of his topics was supposed to reflect his views of the actual succession of cosmic events. The groups of phenomena, *i. e.*, the several great sciences, would, therefore, stand as follows:

1. Inorganic Nature (subdivisions not indicated); 2. Biology; 3. Psychology; 4. Sociology; 5. Morality. How closely he has adhered to this scheme is known to all, the only deviation being the merely verbal one of substituting the word Ethics for 'Morality' in the title of the last work.

How he would have subdivided the phenomena of inorganic nature, and how he would have designated and arranged the subdivisions, has remained for the most part a matter of inference. In illustrating the cosmical laws laid down in his First Principles he frequently swept across the whole field and generally began with the nebular hypothesis and astronomical phenomena, then dealt with planetary and terrestrial events, involving the action of heat, light, electricity, etc., and passed to organic phenomena through the chemical process by which the higher compounds have been developed. From this it was inferred by some that his arrangement of the inorganic sciences, had he worked it out, would have been the same as Comte's, viz: Astronomy, Physics, Chemistry.

In 1864 he published his Classification of the Sciences, but even here this question was not answered to the clear comprehension of all, for a classification may be quite a different thing from a genesis or filiation of the groups of phenomena classified. Still, inasmuch as he classed physics and chemistry as 'abstract-concrete' sciences, dealing with the 'elements' of phenomena, while astronomy, geology, biology, psychology and sociology were classed as 'concrete' sciences, dealing with the 'totalities' of phenomena, it was safe to assume that it was to the latter group alone that he proposed to confine his Synthetic Philosophy; and in the larger table of the concrete sciences, after making astronomy coördinate with the combined phenomena of 'astrogeny' and 'geogeny,' he arranged under the last of these groups, biology and the other organic sciences in a scale of progressive subordination.

In an article dated December 3, 1868, and published as an appendix to the first volume of his Principles of Biology (not, of course, to the first edition, which appeared in 1867), he says; "I am placed at a disadvantage in having had to omit that part of the System of Philosophy which deals with Inorganic Evolution * * * which should * * * precede the *Principles of Biology*. Two volumes are missing. The closing chapter of the second, were it written, would deal with the evolution of organic matter —the step preceding the evolution of organic forms;" and he then proceeds to discuss this aspect of the subject in connection with the doctrine of spontaneous generation, respecting which he had been misunderstood by his critics. He deals with it mainly from the chemical standpoint, as, indeed, he also does in the opening chapters of that volume.

Once more, at the very beginning of his Principles of Sociology, the first part of which appeared in 1874, he remarks: "Of the three broadly distinguished kinds of Evolution, we come now to the third. The first kind, Inorganic Evolution, which, had it been dealt with, would have occupied two volumes, one dealing with Astrogeny and the other with Geogeny, was passed over, etc." This would seem to leave no further doubt upon the point in question.

Mr. Ward added that he had recently received a letter from Mr. Spencer in which the series was given complete according to his present view of the subject, and in which he admitted that he had aimed to confine the treatment in the Synthetic Philosophy exclusively to the concrete sciences as defined in his Classification of the Sciences. This latest version of the matter is given in the right-hand column of

the following table, the final arrangement of Comte being shown in the left-hand column for porposes of comparison:

System of Auguste Comte.	System of Herbert Spencer.
1. Astronomy.	1. Astronomy.
2. Physics.	2. Geology.
3. Chemistry.	
4. Biology (including	3. Biology.
5. Cerebral Biology).	4. Psychology.
6. Sociology.	5. Sociology.
7. Ethics.	6. Ethics.

Mr. Ward said that he would himself agree with Spencer in admitting psychology to equal rank with the other members of the series, but that he would differ from both Comte and Spencer in assigning such rank to ethics, which he regarded a subdivision of sociology.

When it is remembered that the question involved is solely that of the natural order of evolution, or genesis of the successive groups of phenomena, and not that of the logical relationships of the sciences that have to deal with them, still less that of the historical order in which these sciences have been cultivated, it seems clear that it makes little difference whether, with Comte, the attention is concentrated more upon the laws governing the phenomena, or, with Spencer, upon the objects manifesting the phenomena. The series is virtually the same in either case, and it may be fairly claimed that it embodies the largest truth which the universe presents.

Mr. Ward's paper was discussed by Mr. J. W. Powell and Mr. Henry Farquhar.

W. C. Winlock,
Secretary.

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 114th regular meeting was held February 6th. Mr. Schwarz read a communication on the 'Sleeping Trees of Hymenoptera in Southwestern Texas.' Sleeping specimens of two species of Apidæ, *Melissodes pygmæus* and *Coelioxys texana* could frequently be seen near San Diego, Texas, in the early morning hours on the thinnest twigs and thorns of dead bushes of *Celtis pallida*. The sleeping bees hold the twig or thorn firmly grasped with all six legs, and further secure their position by inserting the tips of the widely separated mandibles firmly into the wood. Certain bushes of rather small size are selected by the bees as common sleeping quarters, and on such bushes the two Apidæ are always associated with a Sphegid, *Coloptera wrightii*. The similarity of these sleeping quarters with the so-called 'Butterfly' trees, which are the common sleeping places of *Danais archippus* was discussed.

The paper was discussed by Messrs. Howard, Ashmead, Benton, Gill, Stiles and Fernow. Mr. Ashmead had little doubt of the entire novelty of the observations. Mr. Benton described the position of the honeybee when asleep. Drs. Gill and Stiles and Mr. Fernow discussed the question of sleep and rest with other animals.

Mr. Howard read a paper on the transformations of *Pulex serraticeps*, showing that the common household flea, to which so much attention has been attracted during the past few summers in Northeastern cities, is this common cosmopolitan pest of the cat and dog. He gave the results of careful observations made upon different stages of the insect, and showed that the entire life round from the egg to the adult may occupy in the summer at Washington but sixteen days, the transformations being as rapid as at Calcutta, India. This paper was discussed by Messrs. Patten, Fernow, Barnard, Schwarz, Benton, Ashmead, Marlatt and Gill, who told many stories of the habits and ferocity of fleas in different parts of the world.

L. O. Howard,
Recording Secretary.

GEOLOGICAL SOCIETY OF WASHINGTON.

At the forty-second meeting of the Geological Society of Washington, held on Wednesday, January 29, 1896, Prof. C. R. Van Hise, of the University of Wisconsin, presented a communication on the Relations of Primary and Secondary Structures in Rocks, being a continuation of the subject considered at the preceding meeting.

The relations between cleavage and fissility were discussed. It was concluded that fissility in many cases is controlled in its direction by a previously developed cleavage. Further, most rocks, at the surface having the property of cleavage which developed under deep seated

conditions, show, to a greater or lesser degree, a fissility developed when they were nearer the surface.

The relations of the secondary structures, cleavage and fissility, to bedding were considered. It was shown that there is a tendency for the primary and secondary structures to become parallel or nearly so on the limbs of the folds and to intersect each other at the arches and troughs. In case the folding is close the two structures may be so nearly parallel, except at the short turns of the anticlines and synclines, that the fact that there is a discrepancy anywhere is likely to be overlooked and the conclusion reached that in a given district the two structures are everywhere accordant. This mistake in the past has frequently led to great overestimates of the thickness of formations having slatiness or schistosity.

Prof. Van Hise's observations and conclusions were corroborated and supported by Messrs. Diller, Willis and Keith.

W. F. MORSELL.

NATIONAL GEOGRAPHIC SOCIETY.

AT the regular meeting of the National Geographic Society, held in Washington, D. C., February 7, 1896, Prof. W J McGee, of the Bureau of American Ethnology, presented a communication on 'A Sojourn in Seriland,' which was illustrated by lantern slides. The paper was an account of his recent explorations among a hostile, savage and little known people near the Gulf of California. Mr. McGee gave a brief sketch of the country traversed, with special reference to the flora and fauna and the characteristics of the Seri Indians. A feature of the address was a description of thirst, real and extreme thirst, based on the experience and observation of the speaker.

At the lecture on February 14th, Capt. Z. L. Tanner, United States Navy, commander of the United States Fish Commission Steamer Albatross, described the Commission's method of deep sea fishing, and the forms of submarine life brought up by the dragnet. He also described the voyage of the Albatross from the Atlantic to the Pacific, where she visited the Galapagos Islands and ran several lines of soundings for a submarine cable from California to the Hawaiian Islands. The lecture was illustrated by lantern-slide views of scenes both on shipboard and ashore.

W. F. MORSELL.

BOSTON SOCIETY OF NATURAL HISTORY.

A GENERAL meeting was held January 15th; eighty-four persons were present. The proposed By-Laws of the Society were first considered and, after discussion and acceptance of a single amendment, they were adopted.

Mr. William Brewster spoke on the natural history of Trinidad, illustrating his remarks with a series of lantern slides, showing views of the vegetation and of various animals. He sketched the general characters of the island, the temperature, climate, etc., and referred to the value of the government resthouses to travellers and naturalists. The fauna and flora of Trinidad is the same as that of the valley of the Orinoco; many of the birds and plants are identical with those found on the Amazon. The absence of annoying insects was especially noteworthy and the protective coloration of the birds universal. The forests with the scarcity of brilliantly colored animals, and the trees noticeable for the smallness of their leaves, gave a first impression not very different from that derived from a New England forest. Mr. Brewster read from his journal various notes on the characteristics and habits of some of the conspicuous mammals, birds, reptiles, and insects, noting especially the habits of the parasol ants and the fungus-hunting ants, and closed with a reference to the palatableness of the Agouti, Lape, Peccary and Howling Monkey.

SAMUEL HENSHAW,
Secretary.

THE TORREY BOTANICAL CLUB.

THE regular meeting of the Torrey Botanical Club was held on Wednesday evening, January 29th, with 38 persons in attendance. Ten new members were elected.

Dr. Valery Havard, U. S. A., read a very interesting paper entitled 'Drink Plants of the North American Indians.'

These plants were divided into three classes:

1st. Plants yielding alcoholic drinks.

Distillation was unknown to the North Ameri-

can aborigines, and their few alcoholic drinks were such as could be readily obtained by the fermentation of saccharine fluids.

In Mexico the two plants commonly used for these drinks were Maize and Maguey (*Agave Americana*), and, to a lesser extent, the fruit of *Opuntia Tuna*, *O. Ficus-Indica*, *Yucca baccata* and *Y. macrocarpa*.

In the United States the only Indians preparing alcoholic drinks were a few southwestern tribes; Apaches, Pimos, Maricopas, Papagos and Yumas, which probably obtained the knowledge from Mexican natives early in this century. The plants used were Maize (only by the Apaches) *Agave Parryi* and *A. Palmeri*, the pulpy fruit of the Pitahaya (*Cereus giganteus* and *C. Thurberi*) and the bean of the Mezquite (*Prosopis juliflora* and *P. pubescens*).

2d. Plants yielding stimulating, deliriant or intoxicating principles other than alcohol.

The Peyote (*Anhalonium Engelmanni* Lem.) and Mescal Buttons (*Lophophora Williamsii Lewinii* Coulter) of the Rio Grande and North Mexico, the Frijolillo (*Sophora secundiflora*) of Texas, several species of *Datura*, specially *D. meteloides*, and the Cassine or Yupon (*Ilex vomitoria*) of the southern Indians from which they prepared their favorite 'Black Drink.'

3d. Plants yielding palatable and nutritive sap or juice, or, by infusion, pleasant beverages or teas.

The saps most used were those of Maples (*Acer saccharum*, *A. saccharinum* and *A. rubrum*), and to a lesser extent that of Box Elder (*Acer negundo*), of the Butternut (*Juglans cinerea*) and of the Birch (*Betula lenta* and *lutea*).

The juicy plants of desert regions: Leaves and stems of several species of *Agave*, *Opuntia* and *Echinocactus*, the Sotol (*Dasylirion Texanum*) and the Sand Food (*Ammobroma Sonoroæ*).

Plants whose seeds were infused in water for their mucilage, sugar, oils, &c.: Maize, Mezquite and several species of Sage, chiefly *Salvia polystachya*, the Chia of Mexico, and *S. Columbariæ*, the Chia of California and Arizona.

Plants with tart fruit imparting a pleasant acidulous taste to water: Several species of Sumach on the Atlantic and Pacific coasts, the Manzanitas (*Arctostaphylos Manzanita* and *tomentosa*) of California, the Bulberry of the Missouri region (*Shepherdia argentea*), the Soapberry of the Northern States (*S. Canadensis*) and various species of Barberries (*Berberis*).

Plants containg mostly volatile oils, making agreeable, fragrant teas: Sassafras, Spice bush (*Benzoin Benzoin*), Wintergreen (*Gaultheria procumbens*), New Jersey Tea (*Ceanothus Americanus*), Labrador Tea (*Ledum Greenlandicum*), Sweet Goldenrod (*Solidago odora*), Pennyroyal (*Hedeoma pulegioides* and *Drummondi*), *Croton corymbulosus* and *suaveolens*.

Dr. John K. Small presented his 'Preliminary Notes on the North American Species of Saxifraga,' proposing to separate from that genus the two new genera Japsonia and Saxifragopsis.

Dr. N. L. Britton read a paper entitled 'New or Noteworthy species of Cyperaceae.' He proposed a number of new species, reduced two species and submitted a large number of valuable notes, especially on geographical distribution.

Dr. Britton also submitted observations and specimens in support of Pursh's *Lilium umbellatum*, a species which has been uniformly accepted in herbaria as *L. Philadelphicum*. This view was endorsed by Mr. Rydberg.

H. H. Rusby,
Secretary.

NEW BOOKS.

Physiological Papers. By M. Newell Martin. Baltimore, Johns Hopkins Press. 1895. Pp. vii.+264.

Elements of the Theory of Functions of a Complex Variable. By Dr. H. Durège. Authorized translation from 4th German Edition. George Egbert Fisher and Isaac J. Schwatt. Philadelphia, G. E. Fisher and I. J. Schwatt. 1896. Pp. xiii.+288.

A Text-Book of Gas Manufacture for Students. John Hornby. London, George Bell & Sons. New York, Macmillan & Co. 1896. Pp. vii+261. $1.50.

Naturwissenschaftliche Einführung in die Bakteriologie. Ferdinand Hueppe. Wiesbaden, C. W. Kreidel. 1896. Pp. viii. + 268. M. 6.

Die Lehre von den spezifischen Sinnesenergien. Rudolf Weinmann. Hamburg and Leipzig, Leopold Voss. 1895. Pp. 96. 1895. M. 2.25.